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The Impact of a Negative Labor Demand Shock on Fertility - Evidence from the Fall of the Berlin Wall

Hannah Liepmann*

* Humboldt-Universität zu Berlin, Germany

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The Impact of a Negative Labor Demand Shock on Fertility - Evidence from the Fall of the Berlin Wall*

Hannah Liepmann†

Abstract

How does a negative labor demand shock impact individual-level fertility? I analyze this question in the context of the East German fertility decline after the fall of the Berlin Wall in 1989. Exploiting differential pressure for restructuring across industries, I find that throughout the 1990s, women more severely impacted by the demand shock had more children on average than their counterparts who were less severely impacted. I argue that in uncertain economic circumstances, women with relatively more favorable labor market outcomes postpone childbearing in order not to put their labor market situations at further risk. This mechanism is relevant for all qualification groups, including high-skilled women. There is some evidence for an impact on completed fertility.

Keywords: Fertility, Labor Demand Shock, Industrial Restructuring, East Germany

JEL Codes: J13, J23, P36

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†Humboldt-University of Berlin, hannah.liepmann@hu-berlin.de

1 Introduction

Fertility tends to decrease in industrialized countries during recessions (Adsera, 2005, 2011; Sobotka et al., 2011).[1] An extreme example is provided by the case of East Germany. When the Berlin Wall fell in November of 1989, fertility in former communist East Germany plummeted. Figure 1 shows that after 1989, the East German total fertility rate fell well below its West German counterpart, which has been stable since 1980 at an already low level of 1.4 on average. From 1995 onwards, the East German total fertility rate recovered only slowly. The extent of this decline in East German fertility is unique for an industrialized country during a period of peace (Eberstadt, 1994).[2]

The East German fertility decline coincided with the rapid systemic changes caused by the reunification of Germany. These changes implied a shift away from the quasi non-existence of unemployment under the communist regime to a deep and prolonged economic recession (Burda and Hunt, 2001). Many researchers have thus argued that economic uncertainty has played a crucial role in causing the fertility decline (most recently Chevalier and Marie, 2016).[3] However, whereas at the macro level the East German fertility decline is well-documented, the corresponding mechanisms at the micro level are less clear.

In this paper, I analyze how the labor market situation of individual East German women impacted their childbearing decisions. To circumvent the endogeneity of individuals' labor market outcomes, I exploit exogenous variation in the labor demand shock which hit East Germany after the German reunification. This variation stems from differential pressure for restructuring across industries. Because the fall of the wall was not anticipated, the East German setting is particularly suited to this approach and can be interpreted as a quasi-experiment (Fuchs-Schündeln, 2008; Redding and Sturm, 2008; Burchardi and Hassan, 2013). Citizens of the German Democratic Republic did not self-select into industries based on demand conditions that would prevail after the introduction of the market economy. Also, prior to 1989, the East German employment distribution over industries strongly differed from economic structures in market economies. Showing that after 1989,

[1] Schneider (2015) provides U.S. evidence for the Great Recession. Studies finding countercyclical fertility are rare (Butz and Ward, 1979); see also Macunovich (1995).

[2] While it was largely due to postponement of childbearing until later ages (Conrad et al., 1996; Lechner, 2001), there was also a real reduction of births during the 1990s (Kreyenfeld, 2003; Goldstein and Kreyenfeld, 2011).

[3] See also Eberstadt (1994), Conrad et al. (1996), Sobotka et al. (2011) for East Germany and Frejka (2008) for other Central and Eastern European countries.

East German industrial employment structures converged to the market economy benchmark provided by West Germany, I derive a measure for the labor demand shock which abstracts from supply-side adjustments.

Based on rich panel data from German unemployment and pension insurance records, I first establish that the industry labor demand shock impacted individuals' labor market outcomes by increasing unemployment and by inducing mobility across industries. This had a positive impact on fertility: Throughout the 1990s, women more severely impacted by the labor demand shock had more children on average than their counterparts less severely impacted. The effects are economically significant and persist over a period of seventeen years. They are robust when controlling for the presence and income of spouses and when using older cohorts of East German women as a control group. Moreover, the labor demand shock impacted all qualification groups, including high-skilled women, and the results suggest a permanent effect on completed fertility. Overall, the results are consistent with an opportunity cost argument. I argue that in highly uncertain economic circumstances, women in general are afraid that childbearing jeopardizes their positions in the labor market. Women with relatively more favorable labor market outcomes are then less willing to put their current labor market situation at further risk. In the East German context, this mechanism changed the composition of mothers against the backdrop of an overall low fertility level.

This paper is related to three strands of literature. Based on a Bartik-type instrumental variable strategy (Schaller, 2016) and Chinese import competition (Autor et al., 2015), two previous studies also rely on industry-level variation of changes to labor demand in the United States.[4] Despite the differences in context, both studies similarly find that fertility tends to increase as female labor market prospects decline.[5] My contribution to this literature is twofold. To begin with, my analysis focuses on the individual rather than the regional level. Specifically, I follow selected cohorts of women over time as they become older and analyze their childbearing decisions for the extensive and the intensive margin of fertility. This approach allows me to show that the labor demand shock impacted the

[4]See also Perry (2004) who explores heterogeneity depending on women's qualification. Early contributions in this area are Schultz (1985) and Heckman and Walker (1990).

[5]Methodologically similar are studies analyzing shocks to family income or wealth: Exploiting job displacements of husbands (Lindo, 2010) and energy price shocks which increased male wages in a coal mining region (Black et al., 2013), two studies find a positive relationship between family income and fertility. Lovenheim and Mumford (2013) and Dettling and Kearney (2014) investigate real estate price changes and find a positive impact of wealth on fertility.

timing of childbearing, but also had a persistent impact on individual-level fertility in the long term. Understanding such micro-level mechanisms has important implications for the life courses and labor market trajectories of women. These dynamics are also relevant for families, since, for example, parents' labor market outcomes affect children to the extent that socio-economic inequalities persist across generations (Dehija and Lleras-Muney, 2004; Chevalier and Marie, 2016). Additionally, in comparison to Schaller (2016) and Autor et al. (2015) I investigate a different context characterized by economic uncertainty and an overall low fertility level. Contrarily to what one might have expected, my findings reveal that the 'economic uncertainty' argument cannot directly be applied to the micro level, since East German women more severely impacted by the demand shock did not have fewer children.

Second, this paper is related to studies analyzing plant closures. These studies arrive at different conclusions, which highlights the importance of the type of demand shock investigated. For Finland, Huttunen and Kellokumpu (2016) show that female job loss decreases fertility. Del Bono et al. (2015) also find negative effects of job loss on the fertility of female white-collar workers in Austria, which they attribute to career disruptions.[6]

Third, this paper builds on previous studies on the East German fertility decline. My findings are consistent with Chevalier and Marie (2016) who document relatively poor educational outcomes for East German children born after the fall of the wall and explain this by negative selection of mothers. My analysis complements the approach of these authors: While their study analyzes how the selection into motherhood impacts on children's cohort outcomes, my study analyzes women's labor market situations as a mechanism driving the selection into motherhood. Arntz and Gathmann (2014) emphasize returns to experience in market economies as another factor impacting fertility and find that predicted motherhood wage penalties led to lower birth rates among East German women. Bhaumik and Nugent (2011) and Kreyenfeld (2010) investigate the impact of perceived employment uncertainty on fertility in Germany. They find a negative impact for East German women, while a woman's perception of her partner's employment uncertainty (Bhaumik and Nugent, 2011) or a woman's actual unemployment (Kreyenfeld, 2010) have no significant impact. With 290 and 375 women, respectively, the East

[6]Similarly, De la Rica and Iza (2005) show that during the 1990s, the high prevalence of fixed-term contracts which implied a higher threat of job loss was associated with delayed childbearing in Spain.

German subsamples used in these studies are relatively small. Finally, in accordance with my findings, Kohler and Kohler (2002) show that in Russia during the mid 1990s, less favorable labor market outcomes, as measured by unemployment and unpaid wages, were in several cases positively correlated with fertility.

This paper proceeds as follows. In the next section, I provide background information on the fertility decline and on industrial restructuring and I develop the measure for the labor demand shock. In Section 3, theoretical expectations are presented. Section 4 includes the baseline empirical model, followed by a description of the data and sample in Section 5. In Section 6, I establish that the labor demand shock impacted labor market outcomes and I analyze its effect on fertility in Section 7. Section 8 contains the extended fertility analysis. Section 9 focuses on the heterogeneity of results by qualification level and age group. Section 10 concludes.

2 Background and Empirical Strategy

2.1 The East German Fertility Decline after 1989

In this section, I provide descriptive evidence to establish which cohorts of East German women were impacted by the fertility decline. For these cohort groups the labor demand shock studied in this paper was of potential relevance for childbearing decisions. In Figure 2, I draw upon my main data set to show the number of quarterly births per 1,000 East German women born between 1944 and 1973. These are divided into six cohort groups. Compared with Figure 1 which captured total fertility rates over time and by region, Figure 2 has two advantages. First, in Figure 2 cohort groups are held constant and are followed over time. This uncovers tempo effects, which concern the age at which women had their children. Second, rather than focusing on women living in East Germany, Figure 2 includes the significant fraction of women who migrated to West Germany (see Hunt, 2006; Fuchs-Schündeln and Schündeln, 2009). Based on Figure 2, it can therefore be ruled out that the fertility decline in East Germany was entirely caused by migration to West Germany.

The two oldest groups in Figure 2 comprise women born between 1944 and 1948 and between 1949 and 1953 (groups 1 and 2). In the German Democratic Republic (GDR),

women had their children at relatively young ages. This is particularly true in comparison with West German women (Huinink and Wagner, 1995; Goldstein and Kreyenfeld, 2011). Accordingly, Figure 2 shows that groups 1 and 2 had already completed their fertility before 1989. Among the third group of women born between 1954 and 1958, merely a small fraction still had children immediately before the fall of the wall, and after 1990 birth rates fell to almost zero (group 3 in Figure 2). By contrast, birth rates for the forth group of women born between 1959 and 1963 also declined at an accelerating rate as a result of the fall of the wall, but they remained above zero (group 4 in Figure 2). Finally, birth rates of the fifth and sixth group of women (born between 1964 and 1968 and between 1969 and 1973, respectively) had been increasing until the second quarter of 1990 but drastically decreased thereafter, increasing slightly again only after 1994. While for all other cohort groups birth rates have a clear peak, Figure 2 demonstrates that births are more evenly spread at a lower level during the 1990s among women belonging to the sixth group. These women were aged 17 to 21 at the end of 1990 and therefore their fertility was most drastically impacted by the regime change, causing them to have children at higher average ages compared with their older counterparts.

From Figure 2, I infer that fertility decisions of women born between 1959 and 1973 were impacted by the fall of the wall (groups 4-6). These women were aged 17 to 31 at the end of 1990 and I will focus on these cohorts in the analysis. In contrast, women born between 1944 and 1958 had already completed their fertility before 1989 (groups 1-3). This is due to the young ages at which women had their children in the GDR.

To provide further descriptive evidence, Appendix Figure A1 shows that for women born between 1959 and 1973, the East German fertility decline impacted all birth orders. For these cohorts birth rates for first and second children clearly declined after 1989 and recovered from the mid-1990s onwards. In Appendix Figure A2, annual birth rates are displayed by the highest educational level a woman achieved over her the course of her life. The East German fertility decline was most pronounced for women graduates followed by women with completed vocational qualification. Consistent with the selection effects highlighted by Chevalier and Marie (2016), the decline in birth rates between 1990 and 1991 was smaller among low-skilled women. Birth rates of low-skilled women even increased again after 1991.

2.2 Selection Into Industries

Since this paper exploits variation at the industry level, it is important that the reunification and economic integration of Germany were not anticipated. GDR citizens self-selected into jobs and industries independently of conditions that later prevailed in the market economy. A related argument has been made in the migration literature with regard to pre-determined occupational choices of migrants (Friedberg, 2001; Borjas and Doran, 2012; Prantl and Spitz-Oener, 2014).

In addition, job choices in the GDR were in principle made by the workers themselves, but this was subject to constraints imposed by central planning. When Erich Honecker came to power in 1971, access to higher education was severely restricted. Only very few pupils were allowed to obtain the school diploma which qualified for direct university admission. Apart from good performance in school, the demonstration of political loyalty towards the GDR regime and participation in the "Free German Youth" were necessary prerequisites for being accepted to this school track. Career counseling was meant to influence individuals from an early age onwards to ensure that their occupational choices were made in accordance with available positions. In the sixth school year at the latest, students had to define their desired occupation for the first time. Applications for multiple apprenticeship training positions were officially not possible (Köhler and Stock, 2004; Fuchs-Schündeln and Masella, 2016). In sum, self-selection into industries was exogenous to the labor demand shock studied in this paper because the reunification of Germany was not anticipated and because job choices in the GDR were constrained by central planning.

2.3 Employment Development by Economic Sector

As the market economy was introduced in formerly communist East Germany, East Germany experienced a sharp reduction in labor demand. I now discuss the labor demand shock across broad economic sectors. At this level of aggregation I was able to compile reliable and consistent employment data for a time series of several decades. This time series illustrates why the East German labor demand shock can be interpreted as a quasi-experiment.

For this purpose, Figure 3 shows absolute employment in East Germany by sector from 1970 through 2007. The figure clearly reveals that before 1989 sectoral employment structures were remarkably stable in the GDR. This stability reflects that central planners

in the GDR pursued an extensive growth strategy, which was based on a mere expansion of production. There was no transition to an intensive growth strategy, which would have fostered productivity increases and corresponding adjustments of the sectoral structure. In the 1980s, political attempts to reallocate East German workers failed, since firms engaged in labor hoarding. Also, workers were reluctant to leave firms as these had an important social function. Therefore, changes of the sectoral structure, which would have improved the competitiveness of the East German economy, did not take place (Grünert, 1996; Ritter, 2007).

Figure 3 also shows that with the reunification of Germany, employment structures by sector changed dramatically. This is further illustrated in Figure 4, which displays relative employment changes by sector after 1989. Compared with initial employment levels, employment losses were especially drastic in agriculture, manufacturing, and 'mining, energy & water supply' where employment figures declined by up to 75 percent until 1993. These losses are followed by employment losses in local and regional authorities and in transport and information transmission. Much less pronounced relative employment losses occurred in retail, not-for-profit organizations, and services. In contrast to most other sectors, the service sector grew from 1993 onwards. The sector comprising local authorities stands out insofar as it decreased until 1991 and increased again thereafter. Finally, the rather small finance and insurance sector grew strongly, and the construction sector experienced a boom which lasted until 1996 when employment started to decrease again.

The employment decline and its variation across sectors were driven by three main phenomena (Lutz and Grünert, 1996). First, employment declined due to migration to West Germany, early retirement schemes, and layoffs of workers with low performance who had been guaranteed jobs in the GDR. Second, many workers in the so-called "*Sector X*" lost their jobs: Those who were employed by the army, the Ministry of the Interior, the Ministry of State Security, and the Socialist Unity Party. Personnel replacements also impacted academic disciplines related to the economic and social system of the GDR. Third and most importantly, there were clear differences in economic structures between the GDR and market economies such as West Germany. It is crucial for the empirical strategy that, between East and West Germany, this included pronounced differences in the distribution of workers across broad sectors and more detailed industries.

2.4 Measure for the Labor Demand Shock Across Industries

In the analysis, I will rely on variation of the labor demand shock at a more detailed level. To give examples within the manufacturing sector, the textiles and wearing apparel industries declined by more than 80 percent between 1989 and 1993, compared with a 57 percent employment decline of the food production industry or with a 41 percent decline of the chemical industry. Within services, the category 'other services (consulting and related activities)' had declined by 19 percent by 1993, whereas the category 'accomodation, homes, laundry, cleaning, waste collection' had increased by 40 percent.[7]

However, percentage changes in employment are endogenous to supply-side adjustments, which could be related to childbearing decisions. To abstract from supply-side adjustments, I derive an exogenous measure for the labor demand shock. I exploit that the distribution of employees across industries differed strongly between East and West Germany in 1989. These differences are correlated with East German employment changes by industry after 1989.[8] This relationship is depicted in Figure 5 where absolute employment changes occurring between 1989 and 1993 in East Germany are regressed on percentage point differences in pre-reunification East and West German industrial employment shares. The figure shows a negative correlation. Thus, the larger an East German industry was in 1989 relative to its West German counterpart, the stronger tended to be the absolute East German employment decline of this industry.

From an individual worker's point of view, the relative rather than the absolute employment decline of an industry is relevant, as it is directly related to the risk of job loss. I therefore define the following measure of relative excess supply (RES):

$$RES_{j,89} = \frac{(Empl\_East_{j,89}/Total\_Empl\_East_{89}) - (Empl\_West_{j,89}/Total\_Empl\_West_{89})}{Empl\_East_{j,89}/Total\_Empl\_East_{89}}. \tag{1}$$

The numerator in equation 1 accounts for percentage point differences in East and West German industry structures in 1989. The larger the numerator is, the greater is the

[7]The data sources these figures are based on are provided in the explanation below Figure 5. Note that 1993 was chosen as the reference year, because the major employment changes occurred up until 1993.

[8]Fedorets (2011) estimates the impact of occupational switches on earnings using the 1990 size of an occupation in West Germany and the 1993 occupational unemployment rate as instruments. Her first instrument is related to my approach, since it rests on the argument that West German labor demand is correlated with East German labor demand after 1989.

excess supply of East German workers in an industry j relative to the market economy benchmark of West Germany. Accordingly, one can expect East German employment in j to decline. The denominator relates this percentage point difference to the relative size of an East German industry, since a given percentage point difference between East and West German employment shares should matter more for a relatively small East German industry than for a larger East German industry.

In Figure 6, relative employment changes by industry are regressed on the RES measure. Relative employment changes are captured by the percentage change in employment of an East German industry between 1989 and 1993. The figure demonstrates that relative employment changes of an East German industry are negatively correlated with 1989 employment differences in East and West German employment structures, as measured by the RES variable. Therefore, the RES measure is a good predictor for the relative employment decline of an East German industry after 1989. This variable is exogenous to labor supply-side adjustments such as potentially selective fertility decisions or migration to West Germany and other movements out of the East German labor force.

The relationships displayed in Figures 5 and 6 can be rationalized by two arguments. First, market forces led to a convergence of the distribution of East German employees to the West German standard. After all, West German industry structures had evolved such that the West German economy was relatively successful internationally. Second, as part of the massive privatization of East German firms by the 'Trust Agency,' decisions were made on a case-by-case basis, while industrial policy concerns such as regional spill-over effects played a subordinate role. In this context, East German firms were frequently bought by and integrated into West German firms belonging to the same industry and, for example, were established as suppliers of intermediary input goods (Wahse, 2003; Federal Institute for Special Tasks Arising From Unification, 2003).

Finally, the industry comprising 'social insurance agencies' is an exceptional case. Merely 0.07 percent of total East German workers were employed in social insurance agencies in 1989. Under the influence of West German institutions, this industry was completely reorganized after reunification and employment increased by 850 percent between 1989 and 1993. The RES value is similarly extreme. Those East Germans initially employed in social security agencies were frequently replaced by newly hired employees (Bernien et al., 1996) such that the massive expansion of their initial industry was not relevant

to their labor market histories. Therefore, the main analysis excludes employees initially employed in social security agencies. I discuss this case in more detail in the Appendix.

3 Theoretical Expectations

From a theoretical neoclassical point of view, it is a priori unclear how the RES demand shock impacts fertility (e.g., Becker, 1965). In general, one would expect a labor demand shock to decrease wages. According to neoclassical theory, the impact of a labor demand shock on fertility thus depends on the substitution effect, which states that a decline in wages increases fertility as a result of lower opportunity costs of child-rearing. It also depends on the income effect, which implies that a decline in wages decreases fertility because it reduces total income and because child-rearing is costly. The overall impact is an open empirical question.[9]

It has been argued that the higher a woman's qualification level is, the more likely it becomes that the income effect dominates (Gronau, 1977; Perry, 2004). The RES shock would then have a negative impact particularly on the fertility of high-skilled women. In the context of East Germany after the German reunification, however, the highly uncertain economic situation may have caused women to fear that childbearing jeopardizes their jobs in a given year as well as their labor market prospects in future years. The better a woman's current labor market prospects were, the more important this opportunity cost argument may have been. This would then imply a positive impact of the RES demand shock on fertility, which could be rationalized even for high-skilled women. This positive effect should concern both the decision to have a first child as well as the number of children a woman has (Aaronson et al., 2014). Moreover, the argument that some women experiencing a severe labor demand shock are too poor to have any children (Baudin et al., 2015) is less relevant in the German context. This is due to social security benefits which were relatively extensive at least during the 1990s and in comparison to the United States.

[9]Whereas neoclassical theory focuses on hourly wages as the major channel, I will, among other outcomes, establish the impact of the RES demand shock on unemployment. Neoclassical predictions apply to my context if unemployment is interpreted as implying wage reductions.

4 Baseline Estimation

For woman i from industry $j = 1, ..., 48$ and year t, the following simple model is estimated:

$$Y_{itj} = \beta_0 + \beta_1 RES_{j,89} + X'_{it}\beta_2 + X'_i\beta_3 + \gamma_t + \epsilon_{itj}, \tag{2}$$

where $RES_{j,89}$ is the measure for the labor demand shock as derived in Section 2.4. γ_t are time fixed-effects. Since the treatment is time invariant within industries, throughout the paper robust standard errors are clustered at the industry level. I first establish that the RES demand shock impacted individuals' labor market outcomes. The corresponding outcome variables are discussed in Section 6. I then analyze the impact on fertility, where Y_{itj} is a dummy variable equal to one if a woman gave birth in a given year.

To assess how the impact of the demand shock evolves over time, I focus on three distinct time periods. The first period of years 1991 to 1994 refers to the short term and includes the years during which East German fertility plummeted. The second period captures medium-term effects. It includes years 1995 to 1999 during which East German fertility increased again. Finally, the third period is defined as years 2000 to 2007 and refers to the long term. The parameter of main interest is β_1. It measures the average annual impact of the labor demand shock during the respective time periods.

Moreover, I adjust the empirical model to investigate the persistence of the demand shock on fertility. I only include the years of 1994, 1999, and 2007, respectively. The model takes the following form:

$$Y_{itj} = \beta_0 + \beta_1 RES_{j,89} + X'_{it}\beta_2 + X'_i\beta_3 + \epsilon_{itj}. \tag{3}$$

In these specifications, Y_{itj} is the total number of children born between 1991 and the end of a respective year. For women who had no child prior to 1991, I additionally focus on the outcome of still being childless at the end of a respective year, which is captured by a dummy variable.

Across specifications, time variant control variables are age and age squared. All other control variables are constant over time. These include two qualification dummy variables referring to women who in 1991 had no formal qualification and to women who in 1991 had completed apprenticeship training, respectively. Women who in 1991 had graduated

from university are the reference category. Further control variables are dummy variables for the number of children a woman had prior to 1991 (one child, two children and three or more children), and two dummy variables for whether a woman worked in a large city or very large city at the beginning of the 1990s. Another dummy variable for persons who in the GDR were entitled to privileged pensions serves as a proxy for closeness to the regime. A final dummy variable captures whether a woman was still in apprenticeship training in 1991. A more detailed description of the definition and in some cases of the imputation of variables is provided in Appendix Table A1.

5 Data, Main Sample and Summary Statistics

5.1 Main Data: BASiD

The "Biographical Data of Social Security Insurance Agencies in Germany 1951-2009" (BASiD) combine data from the German Statutory Pension Insurance Scheme (*RV*), the Federal Employment Agency (*BA*) and the Institute for Employment Research (*IAB*). The basis of BASiD is the Sample of Insured Persons and their Insurance Accounts 2007 (*Versichertenkontenstichprobe, VSKT*) from the RV, which is merged with data from the BA and the IAB. The VSKT 2007 is a 1 percent sample of insured persons aged 15 to 67 at December 31, 2007 who are still alive and have an active pension insurance account. This refers to persons who are covered by the pension insurance scheme but are not currently receiving pensions.[10] Insured persons contribute to their pension entitlements by means of employment, child care or elderly care, by receiving health insurance in case of long-term illness, or by receiving social benefits such as unemployment insurance. The BASiD data have a rich panel structure. Up until 2007, they provide retrospective information on all spells and events which are relevant to either the pension or unemployment insurance or both.

For the purposes of this study, the BASiD data have three major advantages. First, it is possible to identify former GDR citizens in the data even if they moved to West Germany

[10]German pension data has been estimated to capture 96 percent of the German population aged 15 and older. The coverage of BASiD must be somewhat lower, because BASiD only includes persons younger than 67 who were alive and had an active insurance account in 2007 (Richter and Himmelreicher, 2008). Note also that some voluntarily insured self-employed persons are included in the VSKT 2007; but, these persons are excluded from the BA/IAB data during periods of self-employment. Civil servants are not covered by the data either.

after the fall of the wall. As large proportions of young female East Germans migrated to West Germany during the 1990s (Hunt, 2006; Fuchs-Schündeln and Schündeln, 2009), this is an important feature of the data. Second, the data provide accurate information on the month of birth of a woman's children, because childbearing entails contributions to pension entitlements. This is also true for births before 1989. Finally, sample sizes of BASiD are considerably larger than in alternative German data sources with panel structure.

Because the BASiD data provide information on individuals and not on households, the analysis focuses on the employment situation of women. In East Germany, women and mothers have traditionally had a high labor force attachment (Rosenfeld et al., 2004). For example, among East German mothers with minor children in 1996, only 7.7 percent of mothers with partners and 2.2 percent of single mothers reported transfers from current partners, former partners or other relatives as their main income source. The most important income sources were the mothers' own wages and salaries, followed by public transfers (Federal Statistical Office, 2010, p. 26). Adler (1997) emphasizes the reluctance of East German women to economically depend on their partners. Providing qualitative evidence, she even argues that economic independence from men would be a prerequisite for East German women to have children. In sum, I assume that the labor market situation of East German women mattered by itself. I later confirm this assumption when I add imputed control variables for the presence and income of spouses and show that the results are not driven by assortative mating.

5.2 Sample and Summary Statistics

The sample includes women born between 1959 to 1973 who were aged 17 to 31 at the end of 1990. Because contributory periods in East and West Germany yield different pension entitlements, one can identify former GDR citizens in the data. Specifically, the sample includes women who prior to 1989 had at least one spell related to work or training in the dual system of apprenticeship in the GDR. Additionally, it is required that prior to 1989 no such spells are reported for the women in West Germany.[11] These selection criteria ensure that the women in the sample were integrated in the East German labor market

[11] I am grateful to Dana Müller whose Stata-routine I am using to distinguish between East and West German spells. See also Grunow and Müller (2012).

and that the labor demand shock studied in this paper was relevant to them.

In a final step, the sample is further restricted to women who on January 1st, 1991, worked in East Germany and have non-missing industry information.[12] January 1st, 1991, which is about three months after the German reunification on October 3rd 1990, is the first point in time for which industry information is known for a subsample of East Germans. This results in a loss of sample size since only 51 percent of employed East German women have non-missing industry information on January 1st, 1991. The main final sample consists of 4,234 women. Summary statistics for this sample are provided in Table 1.

To explain the final selection criterion, the East German labor administration became part of the Federal Employment Agency after the German reunification in October 1990 and in the course of a complex process (Schmid and Oschmiansky, 2007). For some firms industry information was reported already in 1991, whereas this information is available for all East German firms from 1992 onwards. It is, however, crucial to infer industry information for the earliest point in time possible. To begin with, industries are only observed for persons who work. Unemployment rates rapidly increased from 9.5 percent among East German women in January 1991 to 20.5 percent a year later (Bundesagentur für Arbeit, 2015). In addition, the earlier that industries are observed, the fewer workers that will have changed industries. Figure 4, which has been discussed before, shows that some employment losses occurred already in the first year after the fall of the wall, but the most pronounced employment losses took place after the first year. Using industry information from January 1st, 1991, thus seems to be a good approximation of industries prior to the fall of the wall. Finally, it makes sense to exclude the year of 1990, because the fertility decline was not apparent during most of 1990.

A remaining concern is the representativeness of the sample distribution over industries. For example, at the sectoral level, the sample share of women working in mining is suspiciously large and the sample share working in services appears to be too small. To correct for discrepancies between the sample distribution and the population distribution, I use the Microcensus of 1991 as an auxiliary data source. In the Microcensus, I identify women

[12] Only women were selected with an East German contributory period to pension entitlements on January 1st, 1991. Among these, workers with non-missing industry information had a mean age of 24.6 (st. dev. of 4.1) in January 1991; which is similar to the mean age of 25.0 (st. dev. of 4.0) of workers with missing industries.

born between 1959 and 1973 who live in East Germany and compile their distribution over industries.[13] For each woman from an industry j, I then calculate the following simple post-stratification weight:

$$w_j = \frac{share\_Microcensus_j}{share\_sample_j}, \tag{4}$$

where $share\_Microcensus_j$ is an estimate of the population share of this industry. Throughout the paper, I apply w_j as probability weights.[14]

6 Analysis of Labor Market Outcomes

Only if the demand shock measure impacted individual-level labor market outcomes, is it plausible to also expect an impact on fertility. Therefore, I establish the relevance of the RES demand shock for individuals' labor market outcomes in Table 2. The first outcome variable is the incidence of unemployment, which is captured by a dummy variable equal to one if a women experienced an unemployment spell in a given year. The second outcome variable is the duration of unemployment expressed in months per year, which is set to zero for women without any unemployment spell. Third, industry changes are defined as a dummy variable equal to one if a woman started to work in a new industry in a given year. Finally, migration to West Germany is accounted for by a dummy variable equal to one in the year migration took place.

The scale of the RES measure is not intuitive. To facilitate the interpretation of results, I compare estimated effects for women who initially worked in industries subject to a severe labor demand shock with estimated effects for women who initially worked in industries which were less severely hit. Specifically, I compare women at the 90th percentile of the RES measure (which is 0.58 and stands for a severe labor demand shock) with women at the 10th percentile (which is -0.91 and implies that the labor demand shock was less severe). Throughout the paper, tables include rows labeled 'P90 vs P10.' In these rows, the difference in estimated effects between the 90th and the 10th percentile is reported.

[13] I use the Scientific Use File, which is a 0.7 percent representative sample of the population. Respondents are by law required to participate in the survey. The Microcensus was conducted in April, when unemployment had already increased strongly. Therefore the distribution is based on current industries of employed women and last industries of non-employed women.

[14] Weighted and unweighted results are consistent in a qualitative sense. But, effects in unweighted estimations tend to be somewhat smaller and their statistical significance tends to be weaker.

As shown in Table 2, the impact of the labor demand shock on unemployment is positive and significant and it persists over time. In the short term of years 1991 to 1994, the implied differential increase in the incidence of unemployment is 7.0 percentage points on average per year when comparing a worker at the 90th percentile with a worker at the 10th percentile (Table 2, panel a, column 1). The average implied increase in unemployment duration per year is 0.48 months (panel b, column 1). When additional controls are added, the effects are similar but somewhat smaller. Over time, the effects also decrease, but they remain positive even in the long term (panels a and b, columns 5 and 6).

In addition, the labor demand shock impacted mobility across industries. For the short-term period, a worker at the 90th percentile is estimated to be around 3.3 percentage points more likely to change industries in a given year than a worker at the 10th percentile (panel c, columns 1 and 2). Again, this effect decreases over time but remains positive. Perhaps somewhat surprisingly, there appears to be no systematic association between the labor demand shock and the decision to migrate to West Germany (panel d).[15]

The effects presented in Table 2 are economically significant. After all, the RES measure exploits only one dimension of the labor demand shock. It does not capture other dimensions of the demand shock, such as differences in production technology between East and West Germany or product demand shocks specific to individual industries. Moreover, although the RES demand shock was merely a one-time event, it impacted unemployment and mobility across industries even in the medium and long term.

7 Baseline Fertility Analysis

7.1 Annual Births

In the previous section, it was shown that for women who initially worked in industries subject to a relatively severe labor demand shock, labor market outcomes were less favorable and less stable compared with their counterparts who initially worked in industries less strongly impacted. I now assess whether the demand shock also impacted fertility.

[15]Participation in retraining programs could be another adjustment mechanism, but information on such programs is not available before 2000. Wage effects are also neglected, because after reunification East German wages were determined as part of a political process influenced by West German unions and exceeded market equilibria (Krueger and Pischke, 1995). Besides, wages are observed only for employment liable to social security contributions.

In Table 3, annual births are regressed on the RES demand shock measure. A distinction is again made between the short term, medium term, and long term.

Throughout the 1990s, the demand shock had a positive impact on annual births. During the short-term period of years 1991 to 1994, within the group of East German women, those more severely impacted by the labor demand shock had more children on average than their counterparts who were less severely impacted. Again, I compare the two extremes of women at the 90th percentile of the RES measure with women at the 10th percentile of the RES measure. Between those two extremes, in the short-term period, the difference in the annual likelihood of having a child is 0.53 percentage points higher for women more severely impacted by the demand shock (Table 3, panel a, column 1). This effect is robust regardless of whether further control variables are added (panel a, column 2). In the medium term of years 1995 to 1999, there is also a positive and even larger effect of the demand shock. An evaluation of the effect at the 90th compared with the 10th percentile of the RES measure yields a differential increase of 0.76 percentage points in the average likelihood of having a child per year (panel a, columns 3 and 4). The positive impact of the RES labor demand shock on fertility in the short term and medium term is economically significant. To put it into perspective, throughout the 1990s, on average 4 percent of women had a child in a given year (see Table 1). Finally, in the long term of years 2000 to 2007, point estimates suggest a negative impact of the demand shock on annual births but this impact is statistically insignificant (panel a, columns 5 and 6).

In Panels b and c of Table 3 the analysis is repeated, this time distinguishing between different birth orders. For this purpose, first births and higher-order births are separately regressed on the RES measure. With regard to higher-order births, there continues to be a positive impact of the demand shock throughout the short term and the medium term (panel c, columns 1-4), while in the long term, point estimates are positive but statistically insignificant (panel c, columns 5-6). As far as first births are concerned, the demand shock had a pronounced positive effect throughout the 1990s (panel b, columns 1-4), but in the final long-term period, women more severely impacted by the demand shock were less likely to become mothers than their counterparts less severely impacted by the demand shock (panel b, columns 5-6). Based on these results, one would expect that the labor demand shock in part impacted the timing of first births, such that some of

the positive effects that are found for the 1990s are compensated for later in time. These patterns are analyzed in more depth in the following section.

7.2 Persistence over Time

So far, it can be concluded that the demand shock had a positive impact on annual births throughout the short and medium terms. A subsequent question is whether this positive impact on annual births accumulates to persistent differences in fertility and has a significant influence over an even longer period. Alternatively, it might be the case that the impact of the demand shock on fertility vanishes in the long term. This would imply that the demand shock merely impacted the timing of childbearing.

To investigate this further, in Table 4 I adjust the empirical model. Only the years of 1994, 1999, and 2007, respectively, are included. The estimations now contain all main control variables, since the previous section demonstrated that results are robust to inclusion of controls. In panel a of Table 4 the focus is on initially childless women and their decision to become mothers. This is the extensive margin of fertility. The outcome is a dummy variable equal to one whenever a woman is still childless at the end of a given year. Similar to before, this outcome is regressed on the RES measure. As one would expect based on the previous section, over time, the demand shock decreases the likelihood that a woman is still childless. At the end of 1999, a woman at the 90th percentile of the RES measure is around 6 percentage points less likely to still be childless than a woman at the 10th percentile (Table 4, panel a, column 3). However, up until the end of 2007, the difference in childlessness becomes smaller and is no longer statistically significant (panel a, column 5). This implies that with regard to the decision of initially childless women to become mothers, the demand shock mostly impacted the timing of births. Those women more severely impacted by the demand shock had their first children earlier in time, and those less severely impacted had their first children later.

By contrast, there is a persistent positive impact on the total number of children born even in the long term. This can be seen in panel b of Table 4, which refers to the intensive margin of fertility. The sample now includes all women. The outcome variable is the total number of children a woman had between the beginning of 1991 and the end of 1994, 1999, and 2007, respectively; which is again regressed on the RES measure. By the end of 1999, women experiencing a more severe labor demand shock have around 0.061 births more on

average than women experiencing a less severe demand shock (panel b, column 3). Even by the end of 2007, a positive difference of around 0.050 births remains (panel b, column 5). For comparison, between 1991 and 2007 the average number of births per woman is 0.52 (see Table 1). The persistent effect on the total number of children born is therefore significant in an economic sense.

Since migration to West Germany played an important role for the cohorts studied, it is also of interest how migration impacts these results. In the Appendix, results are therefore reported separately for women who migrated to West Germany and women who remained in East Germany (see Table A2). The positive effect of the demand shock on births during the 1990s is confirmed for both groups. Yet the effects are stronger among non-migrants and persist in the long term only for this group.[16] This is not surprising, as migration to West Germany may have been associated with new economic opportunities. As a result, for migrants it may have become less relevant which industries they were employed in initially. Nevertheless, I continue to include migrants in the following analysis in order to comprehensively assess the effect of the labor demand shock.

Finally, in columns 2, 4, and 6 of Table 4, control variables for husbands are added. The previous analysis has focused on women while neglecting their spouses. This would be a problem if the presence or average income of spouses were correlated in systematic ways with the labor demand shock. Therefore, I again rely on the German Microsensus as an auxiliary data source. At the industry level, I imputed the fraction of women living with a spouse in 1991 as well as 1991 average incomes of spouses and merged these variables with the main sample.[17] These control variables were deliberately imputed for 1991 only, because partnership formation in later years could theoretically be a reaction to the labor demand shock. The impact of these variables on fertility turned out to be insignificant (data not shown). Reassuringly, the impact of the RES demand shock on fertility does not change in any major way when the additional control variables are incorporated. It can thus be ruled out that assortative mating is driving the results presented so far. Because the sample size decreases somewhat once the additional control variables are included, they will be neglected in the following analysis.

[16] With regard to childlessness, the effect even reverses in the long term among migrants.

[17] See Perry (2004) and Raute (2014) who similarly infer information about spouses. Avitabile et al. (2014) is an example of a recent study using the Microcensus to analyze family structures in the context of citizenship reform.

8 Extended Fertility Analysis

8.1 Using Older Cohorts as a Control Group

Although the RES demand shock is exogenous to labor market behavior in the GDR and although job choice in the GDR was restricted by central planning, it is still possible that, across industries, women differ in unobservable characteristics which are correlated with fertility. To account for this possibility, I define the main sample of women born between 1959 to 1973 as 'treated cohorts' and use older East German women born between 1944 and 1958 as a control group. The fertility of this control group was completed before the fall of the Berlin Wall (recall Figure 2) and can serve as a benchmark. For the approach to be valid, the identifying assumption requires that the potential endogeneity of industries is constant between treated cohorts and their older counterparts. In this context, the control group is a natural choice, because the socialization of treatment and control group took place in the GDR and both groups selected into industries within the same institutional environment.

To explain the approach in more detail, I define three time periods also for the control group: years 1976 to 1979 (short term), years 1980 to 1984 (medium term), and years 1985 to 1992 (long term). At the beginning of the three periods the women in the control group were aged 17 to 31, 21 to 35, and 26 to 40. In other words, they were of the same ages as the treated cohorts during the three time periods analyzed in the baseline estimation (short term: years 1991 to 1994, medium term: years 1995 to 1999; and long term: 2000 to 2007). The following modified difference-in-differences model is then estimated separately for the respective short-term, medium-term, and long-term periods:

$$Y_{itj} = \beta_0 + \beta_1 RES_{j,89} + \beta_2 treated\_c_i + \beta_3 treated\_c_i * RES_{j,89} + X'_{it}\beta_2 + X'_i\beta_3 + \epsilon_{itj}. \quad (5)$$

For treated cohorts, t stands for 1994, 1999, or 2007; for control cohorts it refers to 1979, 1984, or 1992. $treated\_c_i$ is equal to one if a woman belongs to the treatment group and equal to zero otherwise. Control variables are analogous to those used in the baseline analysis. j denotes the industry a woman worked in, which for both treatment and control groups is defined as her industry on January 1st, 1991. As in the previous section, I distinguish between the extensive and the intensive margin of fertility. The first

outcome is end of period childlessness, which is a dummy variable equal to one whenever an initially childless woman is still childless at the end of the short-term, medium-term or long-term period. The second outcome is the total number of children a woman had between the beginning of the short-term period and the end of a given period.

Regarding main coefficients, β_1 controls for the endogeneity of industries to the extent that this endogeneity is constant between women in the treatment and in the control group. If across industries women differ systematically in unobserved characteristics correlated with fertility, β_1 accounts for this. β_2 captures differences in fertility between the treatment and control group when these two groups were of the same ages. These differences reflect the impact of the fall of the Berlin Wall as well as any other factor which changed general fertility trends between the treatment and control group. For example, pro-natalist policies took effect in 1972 and 1976 and coincided with high fertility rates among women in the treatment group (Huinink and Wagner, 1995). Note that this does not invalidate the choice of the treatment group, as long as the pro-natalist policies - or other factors impacting fertility trends - did not have a differential impact across industries. Similarly, the availability of childcare declined during the 1990s in East Germany and may have caused fertility to decline among women in the treatment group. But, this was a universal phenomenon impacting all women and their families (Kreyenfeld, 2003; Rosenfeld et al., 2004).[18]

Finally, β_3 measures the impact of the RES demand shock on the fertility of treated cohorts relative to the control group. Under the identifying assumption stated above, β_3 estimates the impact of the RES demand shock on fertility net of the influence of a presumed endogeneity of industries.

8.2 Difference-in-Differences Results

The results of the difference-in-differences analysis are shown in Table 5. The table reveals pronounced differences in fertility between treatment and control group when these were

[18]In the GDR, child care was frequently provided by firms (Ritter, 2007), but all women had access to child care regardless of the industry they worked in. In this context, Rosenfeld et al. (2004) characterize the GDR as a "prime example" for the "state-carer version" of a state incentivizing and even requiring full-time employment of all mothers through comprehensive provision of public child care. Post-reunification, child care became the responsibility of local municipalities such that there were no differences in the access to child care across industries either. Child care coverage declined in East Germany between 1990 and 1998 but was still markedly higher than in West Germany (Kreyenfeld, 2003, p. 310).

of the same ages. Among initially childless women, women in the treatment group are 25 percentage points more likely to still be childless at the end of the short-term period than their older counterparts (Table 5, panel a, column 1, $\hat{\beta}_2$). By the end of the long-term period, the difference in childlessness between treated and control groups has become smaller (panel a, column 3, $\hat{\beta}_2$). This corresponds to the result that part of the East German fertility decline after the fall of the wall was caused by postponement of first births (Conrad et al., 1996; Goldstein and Kreyenfeld, 2011). In addition, there are differences in the total number of births. Even by the end of the long-term period, women in the treatment group had 0.279 births less on average than their older counterparts (panel b, column 3, $\hat{\beta}_2$). This reveals that for the women in the treatment group, the overall fertility level decreased as a result of the fall of the wall. It is plausible that some women in the treatment group still had children after 2007 and thereby partly reduced this difference in the total number of births. Due to the right-censoring of the data in 2007, it is beyond the scope of this paper to address this question comprehensively. According to Goldstein and Kreyenfeld (2011) the East German fertility did not only impact the timing of births but also had a depressing effect on the total number of children born.

Importantly for this paper, the results on the impact of the demand shock on fertility are robust to the inclusion of the control group. Recall that $\hat{\beta}_1$ captures the presumed endogeneity of industries. The parameter is small according to point estimates and almost always statistically insignificant. This is the case whether childlessness or the total number of births are the outcome variables. Thus, a presumed endogeneity of industries is not a concern. The only exception is the impact of the RES measure on the total number of births during the initial period (panel b, column 1, $\hat{\beta}_1$). In this case $\hat{\beta}_1$ is in fact negative. If anything, the positive impact of the RES demand shock on the fertility of the treatment group in the short term has been slightly underestimated in Table 4 of Section 8.2.

The other parameter of interest reflects the differential impact of the demand shock on fertility of the treatment group relative to the control group; that is, net of a presumed endogeneity of industries ($\hat{\beta}_3$, see the interaction terms in Table 5). Reassuringly, the conclusions drawn are similar to those of the baseline analysis discussed in Section 8.2. One difference worth noting is that the negative impact of the RES demand shock on childlessness at the end of the long-term period is now slightly stronger ($\hat{\beta}_3$, panel b, column 3). The 90th versus 10th percentile comparison now yields a difference of 3.3 per-

centage points in the likelihood of still being childless by the end of 2007 (compared with the previously estimated 2.4 percentage points). The statistical significance of this effect has increased compared with the baseline analysis. The opposite is true with regard to the positive impact of the RES demand shock on the total number of children born until the end of the long-term period ($\hat{\beta}_3$, panel a, column 3). The estimated long-term effect is now slightly smaller with women at the 90th percentile of the demand shock measure having 0.039 births more on average than women at the 10th percentile of the measure (compared with the previously estimated difference of 0.050 births). The statistical significance decreased (the p-value is now 0.125). While the difference-in-differences analysis thus changes some details of a nuanced interpretation of the effects, overall it confirms the persistence of the positive impact of the demand shock on fertility.[19] This shows that the main results are not invalidated by endogeneity.

Finally, a direct comparison of the estimates $\hat{\beta}_2$ and $\hat{\beta}_3$ in Table 5 leads to a more differentiated interpretation of the findings. Given that $\hat{\beta}_2$ is in general relatively large in comparison to $\hat{\beta}_3$, the industry labor demand shock mainly altered the composition of mothers, since those experiencing a more severe labor demand shock were relatively more likely to have children throughout the 1990s. At the same time, this effect was not so pronounced that it counterbalanced the overall depressing effect of the fall of the wall on general fertility levels during years 1991 through 2007.

9 Effect Heterogeneity

9.1 Qualification Groups

Effects may differ by qualification level. In Table 6 results are displayed separately for women without formal qualification, with completed apprenticeship degrees, and with academic degrees. Since endogeneity of industries has been shown not the be a major concern, in Table 6 I return to the initial sample of 'treated women.' For each qualification group, I separately regress the total number of children born between 1991 and the end of the short term, medium term, and long term period on the RES measure.

[19]The interpretation is the same when I right censor the data three years earlier for both treatment and control groups to avoid that the control group is observed after 1989 (not shown). Note, however, that the control group had almost completed their fertility in 1989 (Figure 2); and was therefore included until 1992.

The demand shock had a significant positive impact on the total number of children born by women with low qualification levels. A pronounced impact is found already for the short-term period (Table 6, panel a, column 1). This is consistent with Chevalier and Marie (2016) who show that, in general, low-skilled East German women were relatively more likely to have children immediately after the fall of the Berlin Wall. I now document that this general reaction to uncertain times corresponds to the within-group reaction of low-skilled women to the labor demand shock. For high-skilled women, effects are also positive and significant (panel b). For both low-skilled and high-skilled women, effects persist even in the long term (panels a and b, column 3). By contrast, effects are smaller and do not persist in the long term among medium-skilled women (panel c).

It is striking that there are positive effects of the demand shock also among high-skilled women. This indicates that economic opportunities influence childbearing decisions within qualification groups and beyond the effect of educational attainment. In the uncertain economic context of East Germany, it is plausible that women with relatively more favorable or stable labor market situations were less willing to give up their current position in the labor market and that this mechanism also pertains to high-skilled women.

Finally, the cohorts analyzed here were still relatively young in 1991. A significant fraction was initially unqualified but obtained formal qualifications in later years. Alternatively, I could have defined qualification levels as the highest qualification a woman achieved until 2007. This may be a better proxy for socio-economic circumstances and status in the labor market than initial qualification levels. Once I do so, I find positive and persistent effects among women of all three qualification groups. In addition, the effects for women who in 2007 are still low skilled become very pronounced (results are available upon request). However, the labor demand shock as well as childbearing may have impacted subsequent educational attainment. I therefore prefer the results displayed in Table 6.

9.2 Age Groups

In the analysis above, I have found that the positive effect of the labor demand shock persists even in the long term. The data have allowed me to assess these effects over a period of seventeen years, which is a relatively long time span. In 2007, which is the last year included in the analysis, the cohorts I studied were aged 34 to 48. Hence, it might be the case that some of the effects are counterbalanced by births occurring after

2007. However, childbearing among East German women is not very common after age 34. This is indicated by Figure 2 above, which shows that even among women aged 34 to 38 in 2007, their fertility had already been declining before 2007 (Figure 2, group 6). Among women aged 39 and older, only a small fraction still had children in 2007 (Figure 2, groups 4 and 5). It is therefore unlikely that the positive impact of the demand shock completely vanishes after 2007.

In this context it is informative to differentiate the effects by cohort groups. Table 7 shows that the effect of the demand shock on fertility is strongest among the youngest group of women aged 34 to 38 (Table 7, panel a). Intuitively, this can be rationalized by the fact that women belonging to the youngest group did not have many children prior to 1991. Therefore, their fertility was most strongly impacted by the demand shock. It is possible that the positive effect found for the youngest cohorts is partly offset after 2007. However, the second largest effect of the demand shock is found for women aged 44 to 48 in 2007, for whom the demand shock had a persistent and significant impact on fertility also in the long term (Table 7, panel c). This last result is of particular interest. Since very few of these women had children after 2007, the persistent impact found for the oldest cohort group indicates that the demand shock had a positive impact on their completed fertility.

10 Discussion and Conclusion

How does a negative labor demand shock impact fertility? I study this question at the individual level and in the context of the East German fertility decline. My empirical strategy exploits the unexpectedness of the fall of the Berlin Wall as well as variation of the labor demand shock across industries. I develop an exogenous measure for the labor demand shock which relies on pronounced differences in the distribution of workers between East and West German industries prior to the fall of the wall.

I show that the labor demand shock increased unemployment and induced mobility across industries. With regard to fertility, women initially working in industries more severely impacted by the demand shock had more children during the 1990s than their counterparts initially employed in industries which were less severely hit. Even in 2007, the positive impact on fertility still persists. These results are robust when controlling for the presence

and income of spouses and when using older cohorts of East German women as a control group. Whereas the effects are economically significant, they mainly alter the composition of mothers but do not counterbalance the low East German fertility level after the fall of the wall. Moreover, the industry labor demand shock impacted fertility decisions even among high-skilled women and it had an effect on completed fertility.

These findings are consistent with Autor et al. (2015) and Schaller (2016) who exploit industry-level variation in the U.S. context and also show that improved labor market conditions for women tend to decrease fertility. Yet the literature on plant closures finds that fertility decreases among women who lost their jobs (Del Bono et al., 2015; Huttunen and Kellokumpu, 2016). While economic theory can rationalize both types of findings depending on whether income or substitution effects dominate, these ambiguities may be resolved once the importance of the type of labor demand shock is accounted for. Plant closures can have severe implications at the regional level, but it is not unlikely that affected workers move to new firms. As a result, it is intuitively plausible that women experiencing a plant closure prioritize their reentry into the labor market before they have children. By contrast, a demand shock concerning an entire industry may impact acquired human capital in a more fundamental way, thereby influencing job opportunities over a longer time period. In this paper, I have argued that in generally uncertain environments, childbearing may be associated with the threat of job loss. My findings indicate that under such circumstances women with more favorable job opportunities are less willing to give up their current labor market situation.

Finally, how can my findings be reconciled with research attributing the East German fertility decline to economic uncertainty? This paper has demonstrated that the 'economic uncertainty' argument cannot be directly applied to the micro level: Women more severely impacted by the demand shock did not have fewer children. The way in which economic uncertainty caused East German fertility to decline must therefore have been more general and fundamental (see also Frejka, 2008). After all, the reunification of Germany interrupted the previously predictable life courses of East Germans, forcing them to rapidly adapt to a new system. This included a decline in the availability of child care. Moreover, beside 'economic uncertainty' other factors can have caused East German fertility to decline. After the reunification of Germany, the access to higher education as well as occupational choices were no longer restricted by central planning and there was free

movement between former East and West German regions. Thus, new opportunities may have also led to postponement of childbearing (see also Arntz and Gathmann, 2014). In my view, these two lines of argument need not be mutually exclusive: The East German fertility decline may have been caused by interdependencies in these different explanatory factors.

My findings are surprising if one assumes that the labor demand shock studied in this paper is positively correlated with feelings of economic uncertainty. One potential interpretation is offered by Friedman et al. (1994) who extend neoclassical models by arguing that women facing uncertain labor market prospects become mothers as a means to reduce uncertainty. However, previous studies show that East German women who reported worries about job security had a smaller likelihood of subsequently becoming mothers (Kreyenfeld, 2010; Bhaumik and Nugent, 2011). As I have hypothesized in this paper, paradoxically, East German women less severely impacted by the labor demand shock could have been relatively more concerned that they might lose their jobs in a generally uncertain situation. Exploring determinants of individuals' feelings of economic uncertainty in more depth thus seems to be a promising avenue for future research.

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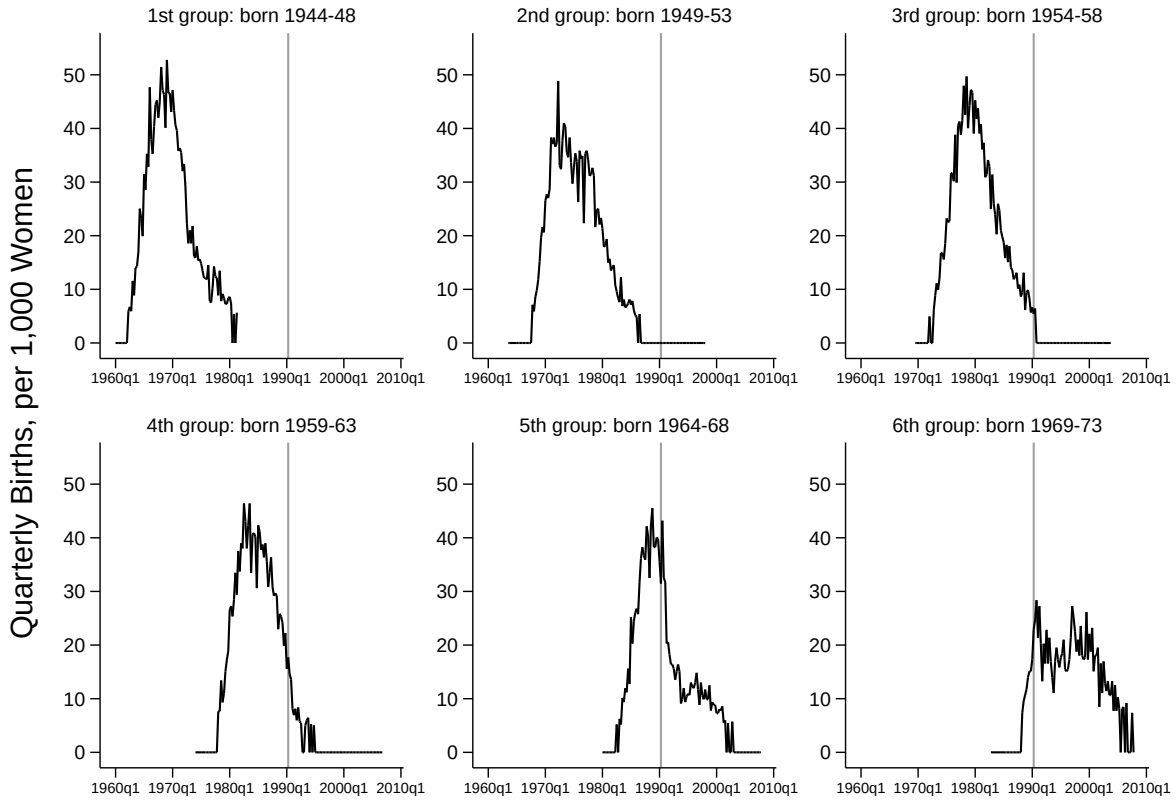
Figure 1: Total Fertility Rates by Region and Year, 1980-2012

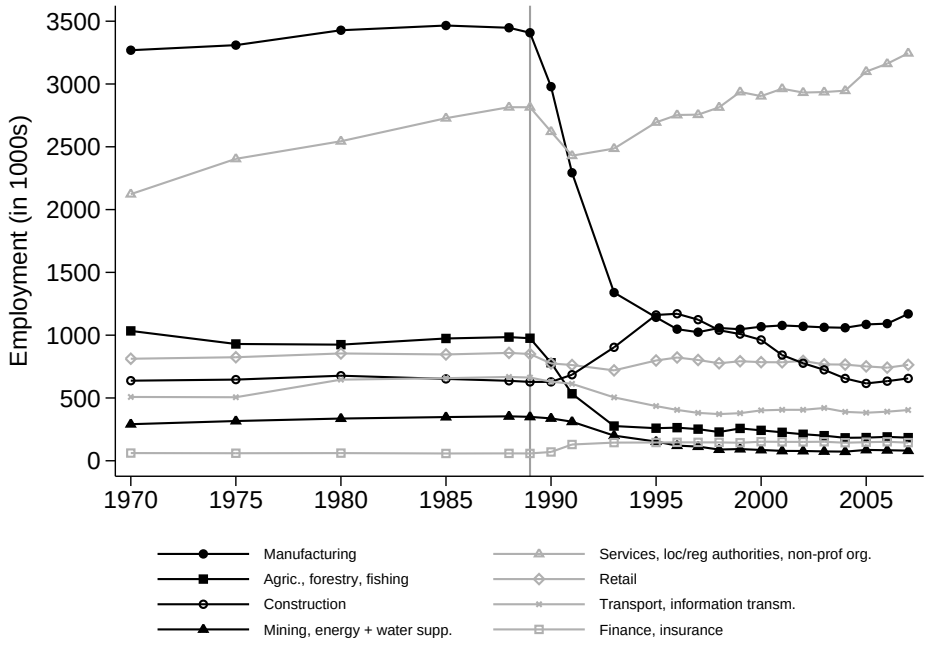
Source: Human Fertility Database, Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria), available at www.humanfertility.org (data downloaded in March, 2015). See Goldstein and Kreyenfeld (2011, p.454) for a similar graph. The total fertility rates is defined for each year as the unweighted sum of all age-specific birth rates for women in their childbearing years.

Figure 2: Quarterly Number of Births per 1,000 East German Women, By Six Cohort Groups



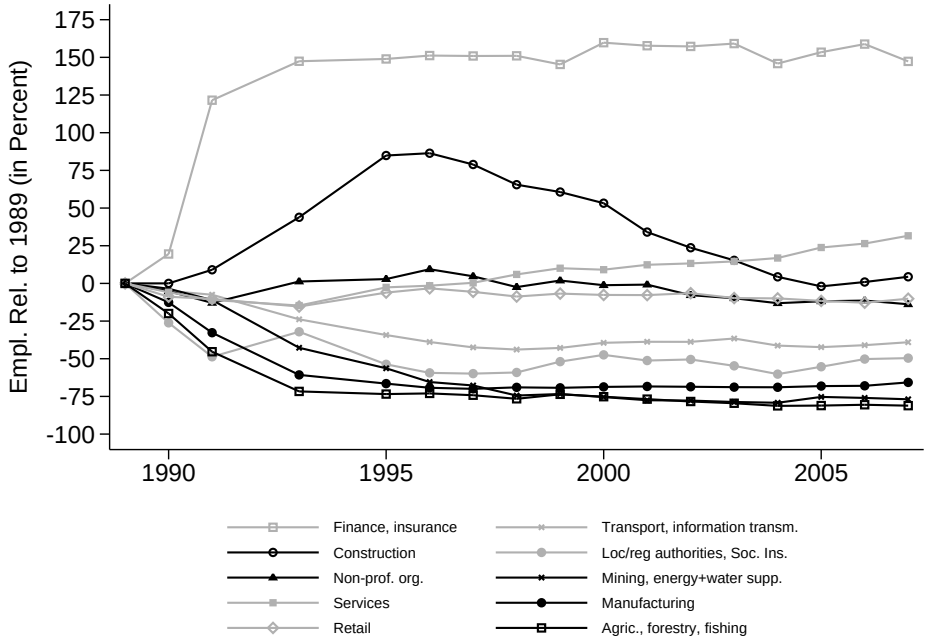
Source: BASiD; based on women who, prior to November 1989, worked or did apprenticeship training in the GDR but not in West Germany, and including women who migrated to West Germany after November 1989. $N = 22,572$. Due to data protection, less than 20 absolute births per quarter had to be censored and are displayed here as zero births. The vertical line stands for the second quarter of 1990. See Section 5.1 for details on the data.

Figure 3: Employment in East Germany (in Thousands), By Economic Sector, 1970-2007 (Selected Years)



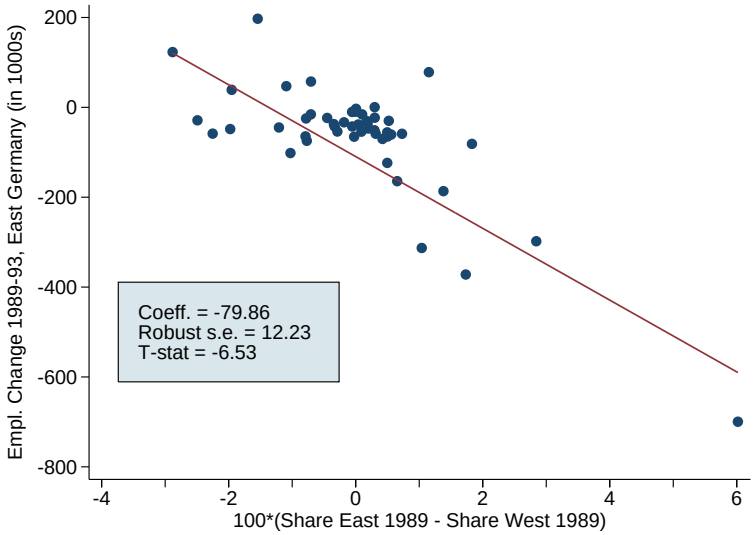
Source: *1970, 1975, 1980, 1985, 1988, 1989:* Federal Statistical Office (1994), which recoded data for the universe of all GDR establishments (the so-called *Berufstätigenerhebung*) according to West German classification schemes, and additionally included persons working for the "*Sector X*" as these did not appear in official GDR statistics (e.g., the army, Ministry of the Interior, Socialist Unity Party, and the Ministry of State Security). *1990:* Bernien et al. (1996, p.16) based on the last *Berufstätigenerhebung* which also covered the universe of all East German establishments and refers to November 30th, 1990. *1991, 1993, 1995-2004:* Author's calculations based on Scientific Use Files of the Microcensus (a 0.7 percent sample of the population) for persons aged 15 and older living in East Germany (including East Berlin) at their main residence; weighted by Microcensus weights. These figures refer to the second half of April, except for 2000 and 2003 (first half of May), 2004 (second half of March), and 2005 onwards (data collected throughout the year).

Figure 4: Employment in East Germany Relative to 1989 (in Percent), By Economic Sector



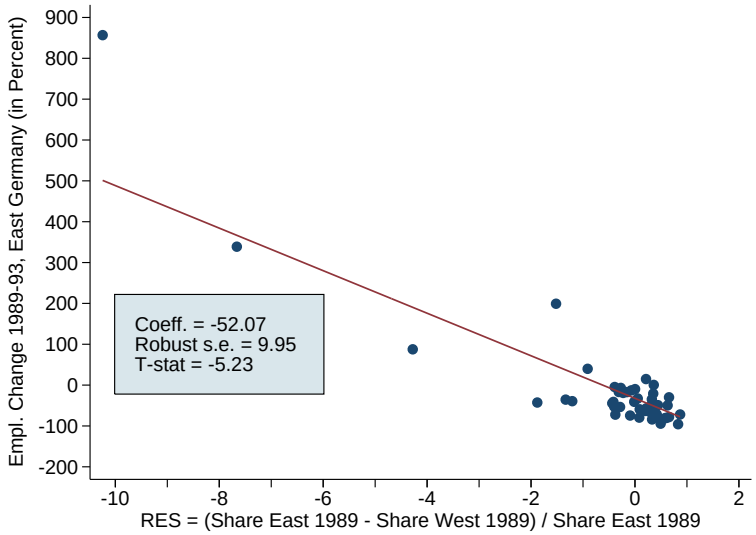
Source: As in the previous figure. Based on Bernien et al. (1996, p.16) it is possible to split up the large category of services, local and regional authorities, and non-profit organizations for 1989 and 1990.

Figure 5: Correlation between the Absolute East German Employment Change 1989 to 1993 (in Thousands) and the Percentage Point Difference of Industrial Structures in East vs. West Germany in 1989, by Industry



Source: Author's compilation based on Federal Statistical Office (1994), Bernien et al. (1996), and Microcensus. $N = 49$, the regression model is weighted using 1989 East German employment shares of industries as analytical weights. 'Private households' (0.03 percent of East German employment in 1989) and 'aircraft and spacecraft construction' (less than 0.03 percent) were so small in the GDR that they are excluded.

Figure 6: Correlation between the Relative East German Employment Change 1989 to 1993 (in Percent) and Relative Excess Supply in 1989, by Industry



Source: As in Figure 5. $N = 49$, the regression model is weighted using 1989 East German employment shares of industries as analytical weights. The industries with the smallest RES values are 'social insurance' followed by 'insurance,' and 'financial intermediation.' The y-axis displays change in percent, i.e., $100 * \frac{Empl\_East_{j,93} - Empl\_East_{j,89}}{Empl\_East_{j,89}}$.

Table 1: Summary Statistics

Panel A: Labor Demand Shock			
RES	-.204	P90, P10 interval	[.583, -.911]
	(.993)	P75, P25 interval	[.324, -.391]

Panel B: Outcome variables, annual averages			
	1991-94	1995-99	2000-07
Unemployment spell in t (0/1)	0.274	0.364	0.299
Unemployment in t (months)	2.431	2.101	1.505
	(4.057)	(3.914)	(3.496)
Industry Change in t (0/1)	0.182	0.120	0.059
Migration to West G. in t (0/1)	0.032	0.016	0.022
Birth in t (0/1)	0.040	0.041	0.019
Outcome variables, end of a given year			
	1994	1999	2007
End of Period Childlessness (0/1)	0.766	0.509	0.355
Total Number of Births	0.163	0.367	0.522

Panel C: Control variables			
Age (here: in 1991)	25.68	2 children bf. 91 (0/1)	0.264
	(4.11)	3 children bf. 91 (0/1)	0.034
Low Qualification, 91 (0/1)	0.255	Privileges in GDR (0/1)	0.057
Med. Qualification, 91 (0/1)	0.706	Appr. Training 91 (0/1)	0.062
High Qualification, 91 (0/1)	0.039	Working in large city, 91 (0/1)	0.099
0 children bf. 91 (reference) (0/1)	0.386	Working in very large city, 91 (0/1)	0.141
1 child bf. 91 (0/1)	0.316		
Sample size; i.e., individuals observed 1991-2007			4,234

Notes: Panel A refers to the industry a woman worked in on January 1st, 1991. Note that in 4 percent of potential person-year combinations, a woman is not observed in the data in a given year, but since the required variables are non-missing for all women and all years, the sample is a balanced sample with $N = 4,234$. Childlessness refers only to women who in 1991 were still childless; 'total number of births' pertains to births between 1991 and the end of a given year.

Table 2: Relative Excess Supply (RES) and Various Labor Market Outcomes, OLS Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	1991-94		1995-99		2000-07	
(a) Dep. Var.: Unemployment Spell in t (0/1)						
RES	0.047***	0.040***	0.039***	0.033***	0.021**	0.017**
	(0.015)	(0.013)	(0.009)	(0.008)	(0.008)	(0.007)
P90 vs P10	0.070	0.059	0.058	0.050	0.031	0.025
(b) Dep. Var.: Unemployment Duration in t (months)						
RES	0.319***	0.264***	0.286***	0.240***	0.174**	0.140**
	(0.101)	(0.087)	(0.057)	(0.047)	(0.072)	(0.059)
P90 vs P10	0.475	0.394	0.426	0.358	0.260	0.208
(c) Dep. Var.: Industry Change in t (0/1)						
RES	0.022***	0.021***	0.015***	0.015***	0.008***	0.007***
	(0.008)	(0.008)	(0.005)	(0.005)	(0.002)	(0.002)
P90 vs P10	0.033	0.032	0.023	0.022	0.012	0.010
(d) Dep. Var.: Migration West in t (0/1)						
RES	-0.002	-0.002	0.000	0.000	0.002**	0.002***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
P90 vs P10	-0.003	-0.003	0.000	0.000	0.003	0.003
Age controls only	yes	-	yes	-	yes	-
Main controls	-	yes	-	yes	-	yes
Time FEs	yes	yes	yes	yes	yes	yes
N	4,234	4,234	4,234	4,234	4,234	4,434

Notes: Each coefficient is from a separate regression. 'Age controls' are age and age squared. 'Main controls' additionally include dummy variables for 1991 qualification, for children born prior to 1991, for living in a large or very large city in 1991, for GDR regime closeness, and for doing apprenticeship training in January 1991. Robust standard errors clustered at the industry level are in parentheses; ***, **, * refers to significance at the 1, 5, and 10 percent level, respectively. 'P90 vs P.10' columns report the differences in the estimated effects between the 90th and the 10th percentile; which is equal to 'coefficient' multiplied by 0.58-(-0.91)=1.49. The model is weighted using post-stratification weights as explained in Section 6.2.

Table 3: RES and Annual Births, OLS Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	
	1991-94		1995-99		2000-07		N
(a) Dep. Var: Birth in t (0/1)							
RES	0.0036***	0.0037***	0.0051***	0.0051***	-0.0010	-0.0009	4,234
	(0.0009)	(0.0012)	(0.0007)	(0.0007)	(0.0009)	(0.0011)	
P90 vs P10	0.0053	0.0055	0.0076	0.0076	-0.0015	-0.0013	
(b) Dep. Var: First Birth in t (0/1)							
RES	0.0053**	0.0053*	0.0046***	0.0042***	-0.0035***	-0.0033***	1,597
	(0.0022)	(0.0029)	(0.0008)	(0.0009)	(0.0007)	(0.0008)	
P90 vs P10	0.0079	0.0079	0.0068	0.0063	-0.0052	-0.0049	
(c) Dep. Var: Higher-Order Birth in t (0/1)							
RES	0.0014*	0.0016**	0.0034***	0.0034***	0.0005	0.0005	4,234
	(0.0008)	(0.0007)	(0.0008)	(0.0008)	(0.0008)	(0.0009)	
P90 vs P10	0.0021	0.0023	0.0050	0.0051	0.0007	0.0007	
Age cont. only	yes	-	yes	-	yes	-	
Main controls	-	yes	-	yes	-	yes	
Time FEs	yes	yes	yes	yes	yes	yes	

Notes: Explanations are analogous to Table 2. The dependent variables are equal to one whenever a woman gave birth in a given year and equal to zero otherwise. In Panel a, this refers to all births, in Panel b to first births, and in Panel c to higher-order births. Results on first births are for women who on January 1st, 1991 were still childless.

Table 4: RES and Total Number of Births/End of Period Childlessness, OLS Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	1994		1999		2007	
(a) Dep. Var: End of Period Childlessness (0/1)						
RES	-0.0215*	-0.0191	-0.0422***	-0.0426***	-0.0162	-0.0169
	(0.0119)	(0.0119)	(0.0110)	(0.0114)	(0.0112)	(0.0121)
P90 vs P10	-0.0320	-0.0284	-0.0629	-0.0634	-0.0241	-0.0251
N	1,597	1,582	1,597	1,582	1,597	1,582
(b) Dep. Var: Total Number of Births (#)						
RES	0.0146***	0.0142***	0.0406***	0.0409***	0.0334***	0.0370***
	(0.0045)	(0.0046)	(0.0044)	(0.0050)	(0.0100)	(0.0096)
P90 vs P10	0.0217	0.0211	0.0605	0.0609	0.0497	0.0552
N	4,234	4,196	4,234	4,196	4,234	4,196
Main controls	yes	yes	yes	yes	yes	yes
Husband controls	no	yes	no	yes	no	yes

Notes: Only the year of 1994, 1999, and 2007 is included, respectively. Regarding 'Total Number of Births', the dependent variable is the number of children born 1991-94 (columns 1-2), born 1991-99 (columns 3-4), and born 1991-2007 (columns 5-6). 'End of Period Childlessness' refers to a dummy variable equal to 1 if a woman is still childless at the end of a given year; here the sample is restricted to women who were childless before 1991. Main controls and standard errors are defined as in Table 2. Control variables referring to husbands are based on the Scientific Use File of the 1991 Microcensus, from which women born 1959 to 1973 living in East Germany were selected. For these, the share living with a spouse as well as average spousal income (set to zero in case no spouse was present) was imputed at the industry level. These two imputed variables were merged to the main sample according to a woman's initial industry. For five industries, no imputation was possible as too few women had a spouse to obtain reliable estimates.

Table 5: RES and Fertility Relative to the Control Group of Older East German Cohorts, Difference-in-Differences Estimates

	(1) Short term	(2) Med. Term	(3) Long Term	N
(a) Dep. Var: End of Period Childlessness (0/1)				
RES ($\hat{\beta}_1$)	0.0040	0.0015	0.0046	3,190
	(0.0222)	(0.0131)	(0.0048)	
Treated Cohorts ($\hat{\beta}_2$)	0.2509***	0.2256***	0.1215***	
	(0.0210)	(0.0193)	(0.0151)	
RES x Treated Cohorts ($\hat{\beta}_3$)	-0.0209	-0.0457***	-0.0223**	
	(0.0214)	(0.0122)	(0.0087)	
P90 vs P10	-0.0311	-0.0681	-0.0332	
(b) Dep. Var: Total Number of Births (#)				
RES ($\hat{\beta}_1$)	-0.0106*	0.0007	0.0063	8,878
	(0.0057)	(0.0068)	(0.0112)	
Treated Cohorts ($\hat{\beta}_2$)	-0.2419***	-0.3220***	-0.2791***	
	(0.0108)	(0.0157)	(0.0257)	
RES x Treated Cohorts ($\hat{\beta}_3$)	0.0227***	0.0381***	0.0258	
	(0.0060)	(0.0067)	(0.0165)	
P90 vs P10	0.0338	0.0568	0.0385	
Main Controls	yes	yes	yes	

Notes: 'Short term' stands for years 1991-94 for treated cohorts born 1973-59 and for years 1976-79 for the control group born 1944-58. 'Medium term' refers to 1995-99 (treatment) and 1980-84 (control); and 'long term' to 2000-07 (treatment) and 1985-92 (control). Only the final year of each of the three time periods is included. In panel a, 'end of period childlessness' refers to a dummy variable equal to one whenever an initially childless woman is still childless at the end of a given period. In panel b, 'Total Number of Births' refers to the number of children born between the beginning of the first period and the end of the final year of the short, medium, and long term period, respectively. Control variables are defined as before, except for qualification now standing for the highest qualification a woman achieved (since 1976 qualification variables are not available for the control group). For the sake of comparability, I use the same post-stratification weights as before.

Table 6: RES and Total Number of Births, OLS Estimates, By Qualification in 1991

	(1) 1994	(2) 1999	(3) 2007	N
(a) Low qualification				
RES	0.0322***	0.0637***	0.0695***	1,147
	(0.0092)	(0.0133)	(0.0203)	
P90 vs P10	0.0480	0.0949	0.1036	
(b) Medium qualification				
RES	0.0073	0.0285***	0.0165	2,929
	(0.0085)	(0.007)	(0.0115)	
P90 vs P10	0.0109	0.0425	0.0246	
(c) High qualification				
RES	0.0306**	0.1156***	0.1203***	158
	(0.0131)	(0.0139)	(0.0145)	
P90 vs P10	0.0236	0.0890	0.0926	
Main controls	yes	yes	yes	

Notes: Explanations are analogous to Table 4. I refer to women without formal qualification, with apprenticeship degrees, and with academic degrees, respectively. As before, 'Total Number of Births' means the number of children born between 1991 and the end of 1994, 1999, or 2007. I no longer control for qualification.

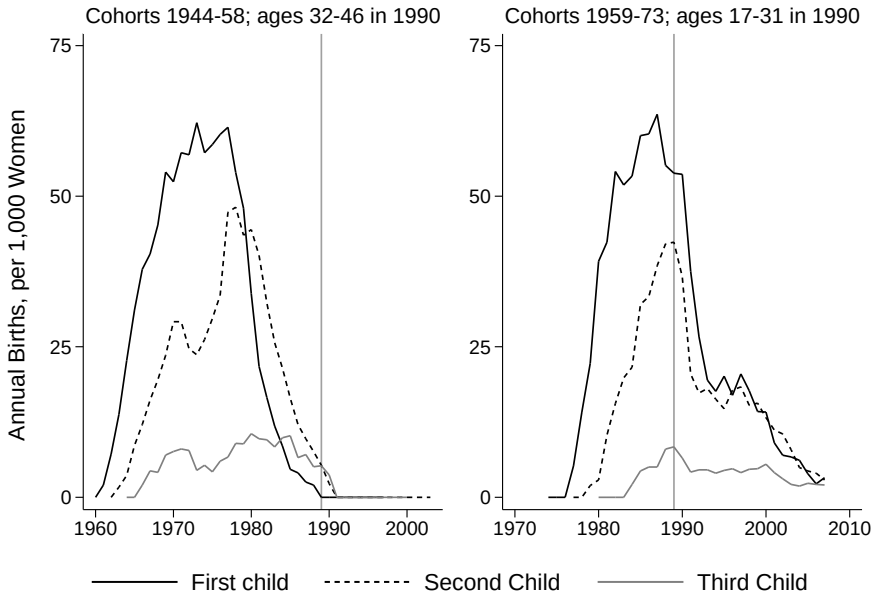
Table 7: RES and Total Number of Births, OLS Estimates, By Cohort Groups

	(1) 1994	(2) 1999	(3) 2007	N
(a) Aged 34-38 in 2007				
RES	0.0236*	0.0745***	0.0588*	1,144
	(0.0120)	(0.0154)	(0.0324)	
P90 vs P10	0.0370	0.1170	0.0922	
(b) Aged 39-43 in 2007				
RES	0.0024	0.0311*	0.0285	1,457
	(0.0131)	(0.0155)	(0.0202)	
P90 vs P10	0.0036	0.0463	0.0425	
(c) Aged 44-48 in 2007				
RES	0.0094*	0.0179***	0.0154**	1,633
	(0.0050)	(0.0052)	(0.0067)	
P90 vs P10	0.0140	0.0266	0.0230	
Main controls	yes	yes	yes	

Notes: Explanations are analogous to Table 4. As before, 'Total Number of Births' means the number of children born between 1991 and the end of 1994, 1999, or 2007.

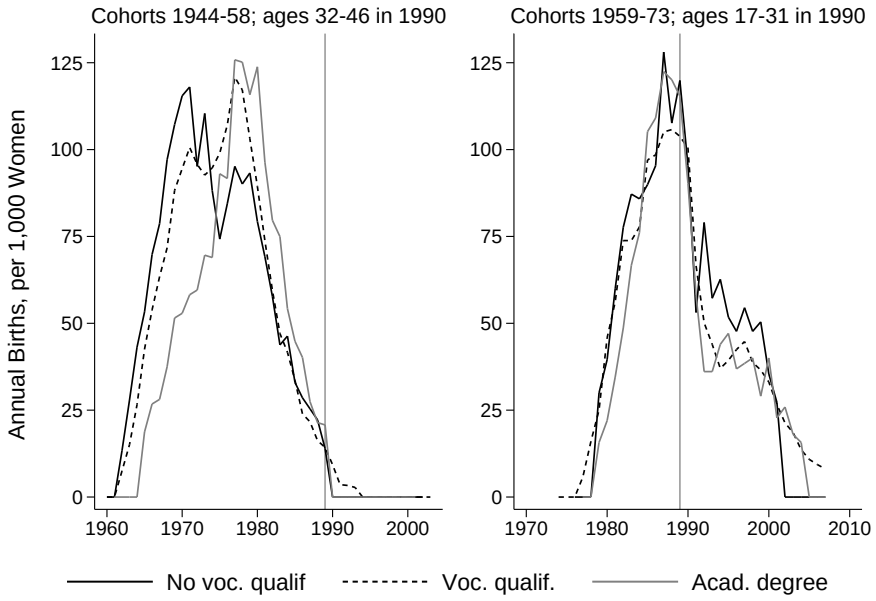
A Appendix

Figure A1: Annual Number of Births per 1,000 East German Women, By Cohort Groups and Birth Order



Source: As in Figure 2. The line stands for 1989.

Figure A2: Annual Number of Births per 1,000 East German Women, By Cohort Groups and Qualification



Source: As in Figure 2. Qualification refers to the highest qualification achieved. 'Low qualification' pertains to women with no vocational qualification, 'medium qualification' comprises women who completed apprenticeship training, and 'high qualification' means women graduates. The line stands for 1989.

Table A1: Description of Variables

Unemployment	Because unemployment transfers are in part means tested (Fitzenberger and Wilke, 2004), unemployment refers to spell with such transfers (unemployment benefits or assistance) or to spells merely entailing contributions towards pensions. Unemployment variables are defined for calendar years; unemployment spells covering multiple calendar years were thus split.
Industry Change	Defined as occurring whenever a woman works in a new industry for the first time.
Migration West	Based on a Stata-routine by Dana Müller. East or West German residence is inferred from employment and unemployment spells and related pension entitlements. There may be gaps in the data; thus, the point of time of migration is determined as the last day of the last spell in East Germany.
Birth	Inferred from month of birth of a woman's children.
Age	Inferred from a woman's month of birth.
Qualification	Imputed and defined following Fitzenberger et al. (2006).
Children Born Bf. 91	Inferred from month of birth of a woman's children.
Large/very large city	Cities are based on the 2009 regional classification scheme; in several cases the definition of city boundaries is broader than at the beginning of the 1990s. Moreover based on the first entry when regional information was non-missing. Large cities are defined as Chemnitz, Halle, Magdeburg, Erfurt and Rostock; very large cities are Berlin, Leipzig, and Dresden.
GDR regime closeness	Proxied by GDR pension privileges. Around one third of these pensions were paid to *"Sector X"* employees and two-thirds to persons in positions considered as important, including part of the intellectual elite and pedagogues (Schmähl, 2007).
Apprenticeship Training	Spell at January 1st, 1991, referred to apprenticeship training.

Table A2: RES and Total Number of Births/End of Period Childlessness, by Migration Status, OLS Estimates

	Non-Migrants			Migrants		
	(1)	(2)	(3)	(4)	(5)	(6)
	1994	1999	2007	1994	1999	2007
(a) Dep. Var: End of Period Childlessness (0/1)						
RES	-0.0144	-0.0451***	-0.0363**	-0.0404**	-0.0360	0.0398*
	(0.0159)	(0.0109)	(0.0158)	(0.0190)	(0.0252)	(0.0207)
P90 vs P10	-0.0214	-0.0673	-0.0541	-0.0615	-0.0548	0.0605
N	1,055	1,055	1,055	542	542	542
(b) Dep. Var: Total Number of Births (#)						
RES	0.0108	0.0435***	0.0399***	0.0231**	0.0290***	0.0092
	(0.0076)	(0.0055)	(0.0111)	(0.0087)	(0.0105)	(0.0195)
P90 vs P10	0.0160	0.0648	0.0595	0.0344	0.0432	0.0137
N	3,060	3,060	3,060	1,174	1,174	1,174
Main controls	yes	yes	yes	yes	yes	yes

Notes: As in Table 4, columns (1), (3), (5). A woman is defined as being a 'migrant' if she migrated to West Germany before 2007; all other women are 'non-migrants.'

A.1 Outlier Analysis

My analysis excludes women initially employed in social security agencies. Social security agencies practically did not exist in the GDR. Employment in this industry therefore increased by more than 850 percent between 1989 and 1993. The corresponding RES value is similarly extreme (see Figure 6). Despite this strong employment growth, women initially employed in social security agencies were frequently replaced by new workers. This was part of the complete reorganization of social security agencies after the reunification of Germany (Bernien et al., 1996).

Once I include women initially employed in social security agencies, the economic significance of the RES demand shock decreases. To illustrate this further, in Appendix Table A3 I compare outcomes of women initially employed in social security agencies with outcomes of women initially employed in insurance and monetary intermediation industries. These are two other examples of industries which expanded strongly after reunification, although less so than social security agencies. Table A3 reveals that women initially employed in social security agencies comparatively often experienced unemployment and, in particular, changed industries relatively often. At the same time, their medium-term birth rates were relatively high. In this sense, for women initially employed in social security agencies, less favorable or stable labor market outcomes are again associated with higher medium-term birth rates; but, this stands in contrast to the exceptional employment development of their initial industry.

Table A3: Extreme Cases: Social Security Agencies Compared With Insurance and Financial Intermediation, Various Outcomes, OLS Estimates (Unweighted)

	(1)	(2)	(3)	(4)	(5)	(6)
	1991-94		1995-99		2000-07	
(a) Dep. Var.: Unemployment Spell in t (0/1)						
Soc. Sec. Agencies	0.0211	0.0219	0.0817***	0.0515	0.0430*	0.0214
	(0.0321)	(0.0371)	(0.0291)	(0.0322)	(0.0222)	(0.0243)
(b) Dep. Var.: Industry Change in t (0/1)						
Soc. Sec. Agencies	0.1468***	0.1196***	0.0333	0.0421*	0.0273**	0.0232*
	(0.0294)	(0.0321)	(0.0205)	(0.0242)	(0.0107)	(0.0125)
(c) Dep. Var.: Birth in t (0/1)						
Soc. Sec. Agencies	0.0210	0.0064	0.0286***	0.0299***	-0.0035	-0.0006
	(0.0140)	(0.0178)	(0.0101)	(0.0093)	(0.0081)	(0.0076)
Age controls only	yes	-	yes	-	yes	-
Main controls	-	yes	-	yes	-	yes
Time FEs	yes	yes	yes	yes	yes	yes
N	228	228	228	228	228	228

Notes: Each coefficient is from a separate regression. It refers to a dummy variable equal to one for women who worked in social security agencies on January 1st, 1991; this dummy variable is equal to zero for women who worked in insurance or financial intermediation on January 1st, 1991. Control variables are analogous to Table 2. Robust standard errors are in parentheses; ***, **, * refers to significance at the 1, 5, and 10 percent level, respectively. No weights were used this time.

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